CLAIMS

1. A method of manufacture comprising the following steps:

intermittently advancing a first elongated continuous structure made of flexible material along a process pathway that passes through a joining station, each advance of said first elongated continuous structure being substantially the same distance;

after each advancement of said first elongated continuous structure, joining a respective portion of a second elongated continuous structure made of flexible material to a respective portion of said first elongated continuous structure at said joining station while said respective portions are stationary; and

applying a torque to a roller in contact with said second elongated continuous structure at a nip located upstream of said joining station, the applied torque being directed opposite to a load torque exerted on said roller by said second elongated continuous structure when the latter is pulled along said process pathway by said advancing first elongated continuous structure joined thereto, the applied torque having a magnitude sufficient to produce a desired tension in the portion of said second elongated continuous structure disposed between said nip and said joining station.

2. The method as recited in claim 1, wherein for the applied torque is substantially constant during a work cycle.

3. The method as recited in claim 1, wherein said first elongated continuous structure comprises a web of packaging film while said second elongated continuous structure comprises a plastic zipper strip.

4. The method as recited in claim 1, further comprising the step of deforming a part of the tensioned portion of said second elongated continuous structure while the tensioned portion is stationary.

5. The method as recited in claim 1, further comprising the step of inserting an article on a part of the tensioned portion of said second elongated continuous structure while the tensioned portion is stationary.

6. The method as recited in claim 1, further comprising the step of thermoforming a respective section of said first elongated continuous structure to form a respective pocket before that section is joined to said second elongated continuous structure.

7. An apparatus for controlling tension in continuous zipper material being fed to a packaging machine, comprising:

first and second rollers forming a nip through which the zipper material passes; and

a torque control device operatively coupled to said first roller, said torque control device applying an output torque that is opposite in direction to a load torque applied to said one roller by the nipped portion of the zipper material when the latter is pulled through said nip.

8. The apparatus as recited in claim 7, wherein said torque control device comprises a magnetic particle clutch.

9. The apparatus as recited in claim 7, wherein said torque control device comprises an input shaft, an output shaft, and means for coupling said output shaft to said input shaft, said coupling means causing said output shaft to slip relative to said input shaft when a load torque on said output shaft exceeds an oppositely directed output torque being applied to said output shaft.

10. The apparatus as recited in claim 9, further comprising a first belt that operatively couples said output shaft of said torque control device to said first roller.

11. The apparatus as recited in claim 9, further comprising a motor comprising a drive shaft, and a second belt that operatively couples said drive shaft of said motor to said input shaft of said torque control device.

12. The apparatus as recited in claim 7, further comprising an accumulator that accumulates one or more package lengths of said zipper material after said package lengths have passed through said nip.

13. The apparatus as recited in claim 7, further comprising an ultrasonic welding assembly designed to deform zipper material into a slider end stop structure after said zipper material has passed through said nip.

14. The apparatus as recited in claim 13, further comprising a slider insertion device for inserting a respective slider on a respective undeformed section of said zipper material between successive slider end stop structures.

15. The apparatus as recited in claim 11, further comprising a reel having zipper material wound thereon and a dancer roller arranged to bear against a portion of said zipper material between said reel and said nip.

16. An apparatus comprising:

a joining station comprising means for joining a respective portion of a first elongated continuous structure made of flexible material to a respective portion of a second elongated continuous structure made of flexible material;

means for intermittently advancing said first elongated continuous structure along a first process pathway that passes through said joining station, each advance of said first elongated continuous structure being substantially the same distance and being separated in time by a dwell time, said joining means being operative during each dwell time;

first and second rollers forming a nip upstream of said joining station;

means for guiding said second elongated continuous structure along a second process pathway, said second process pathway passing through said nip and said joining station, said first and second process pathways being mutually parallel downstream of said joining station; and

a torque control device for applying an output torque to said first roller in a direction opposite to the direction of a load torque exerted on said first roller when said second elongated continuous structure is being pulled by said advancing first elongated continuous structure, the output torque having a magnitude sufficient to produce a desired tension in that portion of said second elongated continuous structure disposed between said nip and said joining station.

17. The apparatus as recited in claim 16, wherein the output torque is substantially constant during a work cycle.

18. The apparatus as recited in claim 16, wherein said first elongated continuous structure comprises a web of packaging film while said second elongated continuous structure comprises a first zipper strip.

19. The apparatus as recited in claim 16, wherein said torque control device comprises a magnetic particle clutch.

20. The apparatus as recited in claim 20, wherein said torque control device comprises an input shaft, an output shaft, and means for coupling said output shaft to said input shaft, said coupling means causing said output shaft to slip relative to said input shaft when a load torque on said output shaft exceeds an oppositely directed output torque being applied to said output shaft.

21. The apparatus as recited in claim 20, further comprising an accumulator that accumulates portions of said second elongated continuous

structure disposed between said nip and said joining station while said first elongated continuous structure is stationary.

22. The apparatus as recited in claim 22, wherein said first zipper strip is interlocked with a second zipper strip, further comprising an ultrasonic welding assembly that fuses and deforms respective portions of said first and second zipper strips that have passed through said nip.

23. The apparatus as recited in claim 22, further comprising a slider insertion device for inserting a respective slider on a respective undeformed section of said interlocked first and second zipper strips.

24. The apparatus as recited in claim 20, further comprising a thermoforming die for thermoforming a respective section of said first elongated continuous structure into a respective pocket before that section is joined to said second elongated continuous structure.

25. A method for controlling tension in a continuous zipper material being fed to a packaging machine, comprising:

pulling the zipper material through a nip formed by first and second rollers and in a direction toward the packaging machine; and

applying a substantially constant torque to said first roller that is opposite in direction to a load torque applied to said first roller by the nipped portion of the zipper material when the latter is pulled through said nip and toward the packaging machine.

26. The method as recited in claim 25, further comprising the step of deforming a first part of the zipper material between the nip and the packaging machine while the zipper material is stationary.

27. The method as recited in claim 26, further comprising the step of inserting a slider on a second part of the zipper material while the zipper material is stationary.

28. A method of manufacture comprising the following steps:

joining a portion of a first elongated continuous structure made of flexible material to a portion of a second elongated continuous structure made of flexible material during a first portion of a work cycle, said second elongated continuous structure having a trailing portion that passes through a nip formed by first and second rollers;

pulling said trailing portion of said second elongated continuous structure through said nip by advancing said joined portion of said first continuous forward during a second portion of said work cycle; and

applying an output torque to one of said rollers during said first and second portions of said work cycle, said output torque being directed opposite to a load torque exerted on said one roller when said trailing portion of said second elongated continuous structure is pulled through said nip.

29. The method as recited in claim 28, wherein said first elongated continuous structure comprises a web of packaging film while said second elongated continuous structure comprises a plastic zipper strip.

30. A system comprising a packaging machine, a zipper processing machine, and a continuous zipper material that follows a process pathway through said zipper processing machine and then through said packaging machine, wherein:

said continuous zipper material comprises a first continuous zipper strip interlocked with a second continuous zipper strip;

said packaging machine comprises a joining station whereat a portion of said first zipper strip is joined to a portion of a continuous packaging material during a first portion of a work cycle, and means for advancing said continuous packaging material during a second portion of said work cycle; and

said zipper processing machine comprises a nip formed by first and second rollers, said first and second zipper strips passing through said nip, and a torque control device operatively coupled to said first roller for applying an output torque to said first roller during said first and second portions of said work cycle, said output torque being directed opposite to a load torque exerted on said first roller when said first and second zipper strips are pulled through said nip.

31. The system as recited in claim 30, wherein said packaging machine comprises a thermoforming die disposed upstream of said joining station for forming a pocket in said packaging material, said zipper material being later joined to said packaging material outside said pocket.

32. The apparatus as recited in claim 30, wherein said torque control device comprises a magnetic particle clutch.

33. The apparatus as recited in claim 30, wherein said torque control device comprises an input shaft, an output shaft, and means for coupling said output shaft to said input shaft, said coupling means causing said output shaft to slip relative to said input shaft when a load torque on said output shaft exceeds an oppositely directed output torque being applied to said output shaft.

34. The apparatus as recited in claim 30, further comprising an accumulator that accumulates portions of said continuous zipper material that pass through said nip while said continuous packaging material is stationary.

35. The apparatus as recited in claim 30, further comprising an ultrasonic welding assembly that fuses and deforms respective portions of said first and second zipper strips that have passed through said nip.

36. The apparatus as recited in claim 35, further comprising a slider insertion device for inserting a respective slider on a respective undeformed section of said interlocked first and second zipper strips.

37. A system comprising a packaging machine, a zipper processing machine, and a continuous zipper material that follows a process pathway through said zipper processing machine and then through said packaging machine, wherein:

said continuous zipper material comprises a first continuous zipper strip interlocked with a second continuous zipper strip;

said packaging machine comprises a joining station whereat a portion of said first zipper strip is joined to a portion of a continuous packaging material during a first portion of a work cycle, and means for advancing said continuous packaging material during a second portion of said work cycle; and

said zipper processing machine comprises a slider insertion device and tension control means for maintaining a substantially constant tension of said zipper material in a zone from said slider insertion device to said joining station during said first portion of each work cycle.

38. The system as recited in claim 37, wherein said tension control means comprise a dancer assembly.

39. The system as recited in claim 37, wherein said tension control means comprise a pair of rollers forming a nip and a torque control device coupled to one of said rollers.